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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 45457.1-2025

Heavy-duty gas turbine blades - Non-destructive testing - Part 1: Film radiographic testing

重型燃气轮机叶片无损检测 第1部分：射线检测

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1.Structure and drafting rules for standardization documents" Drafting. This document is part 1 of GB/T 45457 Nondestructive Testing of Heavy Gas Turbine Blades. GB/T 45457 has been published as follows part.

1.Radiographic testing;

2.Visual inspection. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document is proposed and coordinated by the National Technical Committee for Standardization of Nondestructive Testing (SAC/TC56). This document was drafted by: China United Heavy Duty Gas Turbine Technology Co., Ltd., Shanghai Materials Research Institute Co., Ltd., Suzhou Tianhe CEC Electric Power Engineering Technology Co., Ltd., Institute of Metal Research, Chinese Academy of Sciences, China Nuclear Power Plant Operation Service Technology Co., Ltd., Jiangsu Yonghan Special Alloy Technology Co., Ltd., Yingliu Hangyuan Power Technology Co., Ltd., Nantong Hitech Precision Materials Co., Ltd., Northwestern Polytechnical University, China National Nuclear Corporation Nuclear Power Operation Management Co., Ltd. The main drafters of this document are. Shu Guogang, Ding Jie, Luo Jie, Jiang Jiansheng, Sun Jian, Liu Wei, Lin Shichang, Wu Hong, Guo Yun, Ma Yaofei, Liu Shun, Dong Jiasheng, Huang Chunjie, Ge Bingming, Bian Shuai, He Kunhong, Chen Hua, Wei Shaoming, Li Qiuda, Wang Weidong.

Blades are the core hot end components of heavy-duty gas turbines that convert thermal energy into mechanical energy. Their quality control is crucial to the safe operation of gas

turbines. Nondestructive testing technology is the main means of quality control for heavy-duty gas turbine blades. Heavy-duty gas turbine blades are hollow precision castings. The components are large in size, have complex internal cooling structures, and have large variations in shape, curvature, and thickness, making nondestructive testing difficult. Blade non-destructive testing, establish and unify the requirements for equipment, process, etc. for non-destructive testing of heavy-duty gas turbine blades, and formulate this series of standards. GB/T 45457 "Non-destructive testing of heavy-duty gas turbine blades" aims to establish non-destructive testing methods for heavy-duty gas turbine blades. GB/T 45457 is intended to consist of 2 parts.

1.Radiographic testing. The purpose is to determine the radiographic testing method for heavy-duty gas turbine blades.

2.Visual inspection. The purpose is to determine the visual inspection method for heavy-duty gas turbine blades. This document is Part 1 of GB/T 45457, which specifies the specific technical requirements for the radiographic inspection method for heavy-duty gas turbine blades. Fan, plays a technical support role in the radiographic inspection of heavy-duty gas turbine blades. Nondestructive testing of heavy-duty gas turbine blades Part

1 Scope

Part 1 of China's national standard for the non-destructive testing of heavy-duty gas turbine blades, covering film radiography. A heavy-duty turbine blade is among the most demanding castings made: a single crystal or directionally solidified nickel superalloy, hollow, with internal cooling passages of complex geometry and walls a millimetre or two thick, produced by investment casting with ceramic cores. Radiography is the only method that sees the interior - core shift that has left one wall too thin, shrinkage porosity, inclusions, residual core material blocking a passage - and any of those will destroy the blade in service and possibly the machine with it. Doing it well is difficult: the varying thickness of a cooled aerofoil defeats a single exposure, and the geometry means orientation determines what is visible. This part gives the general principles and specifies the technical levels, testing techniques and the requirements for records and reports.

This document defines the general principles for film radiographic testing of heavy-duty gas turbine blades and specifies the technical levels, testing techniques, and Requirements for test records and reports. This document is applicable to the film radiography inspection of high temperature alloy blades of heavy-duty gas turbines, and other industrial gas turbine blades shall be implemented for reference.

2 Normative references

The contents of the following documents constitute essential clauses of this document through normative references in this document. For referenced documents without a date,

only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 12604.2 Nondestructive testing terminology Radiographic testing

GB/T 15135 Gas Turbine Vocabulary

GB/T 19348.1 Industrial radiographic films for non-destructive testing Part

3 Terms and definitions

The terms and definitions defined in GB/T 12604.2 and GB/T 15135 apply to this document.

4 General Principles

4.1 Radiation protection Without proper protective measures, X-rays or gamma rays can cause serious harm to human health. Use in accordance with the requirements of radiation protection regulations. When carrying out radiation detection work, strictly implement the safety protection measures stipulated by relevant laws and regulations.

4.2 Testing location and environmental conditions

4.2.1 Testing location The space of the testing site meets the requirements of the testing work, and the irradiation area is not affected by the scattered rays from the ground and surrounding walls. A ventilation device with an air exchange rate of not less than 5 times/h shall be installed in the testing place.

4.2.2 Darkroom The temperature of the darkroom is controlled at 15°C~25°C, and a red light of appropriate brightness is installed. The darkroom is divided into a "dry area" and a "wet area".